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(56) Publications considered for evaluation of patentability:
German Patent 27 41 255 A1
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(54) Vibratory sander

(57) The invention concerns a vibratory sander which has a grip portion, a machine housing holding the drive mechanism, and a vibrating head driven by the drive mechanism which can be connected to a sanding tool. The invention solves the problem of providing a vibratory sanding machine or machine system with which sanding processes requiring the use of several different tools can be carried out efficiently. The solution of this problem according to the invention is characterized by the fact that it provides for making a quick connection to join the vibratory head to the tools, comprising a first connecting part fastened to the vibratory head and a second connecting part, which is a counterpart to the first connecting part such that it can be brought into engagement with the first connecting part to make a mechanical link, and a locking mechanism which locks the connecting parts in mutual engagement.

Description

The invention concerns a vibratory sander which has a grip portion, a machine housing holding the drive mechanism, and a vibratory head driven by the drive mechanism which can be connected to a sanding tool.

Vibratory hand sanders of this type are used principally for sanding pieces of wood or other materials used in the woodworking trade. There it is often the case that a multiplicity of different sanding tools are needed because of the different surface shapes to be sanded. It has previously been the usual practice to provide sanding work positions with as many sanding machines as the different sanding tools needed, so that a complete sander with its special sanding attachment is available for each part of the work. Thus the work can be done in rapid sequence with different tools, even though the capital costs are high.

This invention solves the problem of providing a vibratory sander or sanding system by making possible more efficient sanding with less cost for machinery at workplaces where several different sanding tools must be used.

This problem is solved according to the invention by providing a set of different sanding tools and by providing for making a quick connection to join the vibratory head to the tools, comprising a first connecting part fastened to the vibratory head and a second connecting part, which is a counterpart to the first connecting part such that it can be brought into engagement with the first connecting part to make a mechanical link, and a locking mechanism which locks the connecting parts in mutual engagement.

By means of this solution according to the invention it is possible to carry out sanding work requiring many different sanding tools with a single vibratory sanding machine at low capital cost, by making the sanding tools interchangeable. With the connector according to the invention the exchange can be carried out in an acceptably brief time which barely reduces

the efficiency of the sanding work. It has been found, unexpectedly, that an adequately secure connection between the vibratory head and the vibrating tool can be made by the quick connection according to the invention.

One preferred embodiment of the invention provides that the vibratory head and the sanding tool have flat surfaces facing each other and that one of the two locking pieces comprises projections extending out from the flat surface and the other locking piece has depressions extending into the other flat surface, so that the locking pieces are held together in mechanical engagement, preferably through a magnetic force produced by magnetizing the flat surfaces and/or the locking pieces.

In another embodiment of the invention, snap fasteners are provided for quickly connecting the vibratory head with the sanding tools. When snap fasteners are used no special separate locking mechanism is required, as the locking of the connecting parts in their mutual engagement is assured by the snap fasteners themselves.

Another preferred embodiment of the invention provides that the quick-connection mechanism have at least a pair of profiled rails which are mutually embracing in their cross-sections, which can be slid together longitudinally to make the mechanical connection. The profiled rails of the pair can, for instance, have a C profile, or one of the profile rails has essentially a C profile while the other has a T profile. The mechanically linked connecting parts can in this case preferably be locked together by a catch.

Other possible embodiments and advantageous potential developments of the invention appear in the subclaims.

The invention will now be described and explained in detail by means of embodiments and the accompanying drawings which refer to these example embodiments. The drawings show:

Figure 1: a plan view of a first embodiment of a vibratory sander according to the invention;

Figure 1a: a plan view of the vibratory head of the vibratory sander according to Figure 1;

Figure 2: a vibratory head of a vibratory sander connected to a sanding tool according to a second embodiment of the invention;

Figure 2a: plan view of the vibratory head of Figure 2;

Figure 3: a vibratory head of a vibratory sander connected to a sanding tool according to a third embodiment of the invention;

Figure 3a: plan view of the vibratory head according to Figure 3;

Figure 4: vibratory head of a vibratory sander connected to a sanding tool according to a fourth embodiment of the invention.

Figure 4a: plan view of the vibratory head of Figure 4;

Figure 5: vibratory head of a vibratory sander connected to a sanding tool according to a fifth embodiment of the invention;

Figure 5a: plan view of the vibratory head of Figure 5;

Figure 6: vibratory head of a vibratory sander connected to a sanding tool according to a sixth embodiment of the invention;

Figure 6a: plan view of the vibratory head of Figure 6;

Figure 7: vibratory head of a vibratory sander connected to a sanding tool according to a seventh embodiment of the invention;

Figure 7a: plan view of the vibratory head of Figure 7;

Figure 8: vibratory head of a vibratory sander connected to a sanding tool according to an eighth embodiment of the invention;

Figure 8a: plan view of the vibratory head of Figure 8;

Figure 9: vibratory head of a vibratory sander connected to a sanding tool according to a ninth embodiment of the invention; and

Figure 9a: plan view of the vibratory head of Figure 9.

In Figures 1 and 1a, a housing for a vibratory sander is designated with the reference number 1. The housing, in which there are ventilating slots 14, has a grip portion 2 for manipulating the machine. Mounted inside the housing, but not shown in Figures 1 and 1a, there is a drive motor driving an eccentric. An electric power line 43 is led into the housing as a power supply for the drive motor, which is intended to be an electrical motor. 3 indicates a vibratory head which is mounted on rubber blocks 15 so that it can vibrate. It comprises essentially a plate 44 which forms a flat surface 5. 4 indicates a sanding tool, of a set of sanding tools provided. It comprises a base plate 7 having a flat surface 6 matching the flat surface 5, a tool body 8 of a foamed material which is preferably elastic, such as foam rubber, fastened to the base plate 7, and a sanding sheet 9 connected to the tool body. The sanding sheet 9 is preferably connected to the tool body 8 through a Velcro fastener. Numbers 10 and 13 indicate flanges projecting like hooks from the plate 44, shown in cross-section, which mesh with matching flanges 11 and 12 projecting from the base plate 7 of the sanding tool 4. In this embodiment the flanges are produced by making cuts in plates 44 or 7, folding the

flanges up out of the plates, and bending them forward. In this embodiment the flanges 11 and 12 of the base plate 7 are shorter than flanges 10 and 13 of plate 44. Number 36 indicates a catch which comprises a leaf spring 38 fastened with rivets 45 to the base plate 7 of the sanding tool 4, with a locking hemisphere 37 to lock into a matching cutout in plate 44 of the vibratory head 3. A catch could also be made by giving the mutually meshing flanges complementary longitudinal profiles.

To change a sanding head, the sanding tool is slid sideways onto the sanding head, so that the opposing flanges 10 and 11, and 12 and 13, mutually intermesh. At the desired final position, the grinder ball 37 of the catch 36 snaps into a matching concavity in the plate 44 of the vibratory head. Conversely, the catch can also be made so that the catch ball on a leaf spring fastened to the base plate 44 snaps into a concavity in the base plate 7 of the sanding tool. The fact that flanges 10 and 13 on the plate 44 are longer than the flanges 11 and 12 on plate 7 assures that flanges 10 and 13 extend beyond flanges 11 and 12 and always lie with the overlapping parts on plate 7 of the sanding tool, making a connection without play between the vibratory head 3 and the tool 4. To remove a sanding tool from the sanding head, the catch 36 can be unlocked with a suitable tool such as a screwdriver.

Parts 3 to 9 and plate 44 of Figure 1 are designated in the following Figures 2 to 9 with the same reference numbers, but with indices a to h. In order to make it clear that each case is intended to apply to a set of different sanding tools, each one having a standard connecting part, the following figures show tools with differently shaped sanding bodies for different shapes of surfaces to be sanded. That is not specified in detail in the following description.

The example embodiment shown in Figures 2 and 2a has mutually embracing guide rails, so that the plate 44a of the vibratory head 3a carries T-shaped profile rails 16 and 18 which are parallel with each other, while the base plate 7a of the sanding tool 4a has corresponding profile rails made in a C shape, which surround the cross-pieces of the T-shaped profile rails. 39 indicates a catch comprising a pin 41 with a head 42 and a detent ball 37a. The pin 41 passes through a passage in the plate 44a of the vibratory head 3a. There is a coil spring 40 between the flat surface 5a of plate 44a and the detent ball 37a. The detent ball 37a can be pressed toward the plate 44a against the force of the coil spring 40.

To connect the sanding tool 4a to the vibratory head 3a, the sanding tool, carrying the profile rails 17 and 19, is slid from the side onto the profile rails 16 and 18 of the sanding head until the detent ball 37a can snap into the corresponding concavity in the base plate 7a of the sanding tool 4a. In this example embodiment is makes no difference from which side the sanding tool is slid onto the profile rails of the vibratory head.

It would also be conceivable that there would be no sliding, but that the profile rails would be brought into linkage with each other in the manner of a snap fastener. In this case, the catch mechanism could be omitted. Instead of that, stops would be required on both sides of the profile rails for the T or C profile rails.

In the example embodiment of Figures 3 and 3a, plate 44b of the vibratory head 3b has a bar 22 forming a square seat. As a counterpart, the base plate 7b of the sanding tool 4b has a stirrup 23 which can be inserted into the seat. In this example embodiment, an Allen screw 35 is the locking mechanism. It passes through a passage 46 in the stirrup into a threaded hole 48 in the plate 44b. The Allen screw is accessible through a passage 47 in the tool body 8b and in the base plate 7b (before the sanding sheet 9b is applied to the sanding body 8b).

The sanding tool 4b is mounted to the vibratory head 3b by inserting the stirrup 23 projecting from the base plate 7b of the sanding tool 4b into the seat formed by the bar 22 on plate 44b of the vibratory head 3b and tightening the Allen screw to lock the sanding tool. It is possible to provide that each sanding tool of the set of sanding tools be provided with a matching Allen screw, and that the Allen screw be secured to the sanding tool, by means of a lock washer, for instance. Thus it is possible to omit the relatively time-consuming work of having to introduce an Allen screw through the passage 47 every time a tool is changed.

In the example embodiment of Figures 4 and 4a, snap fasteners 24 to 27 are provided, so that the snap fastener seats 24b to 27b are fastened to the plate 44c of the vibratory head 3c and the snap fastener plungers 24a to 27a are, correspondingly, fastened to the base plate 7c of the sanding tool 4c. The snap fasteners 25 and 27 and the snap fastener plungers 26a and 27a do not appear in Figures 4 and 4a. Conversely, the snap fastener seats could be fastened to the base plate 7c with the snap fastener plungers correspondingly fastened to plate 44c of vibratory head 3c. Instead of four snap fasteners corresponding to the corners of a square, there could, for instance, be only three snap fasteners corresponding to the corners of a triangle. No separate locking mechanism is needed in the example embodiment in Figures 4 and 4a because the snap fasteners themselves provide adequate locking. To remove the sanding tool 4a from the vibratory head 3a, a suitable tool, such as a screwdriver, can be introduced into the space between plates 44c and 7c to pry the snap fasteners apart.

In the example embodiment shown in Figures 5 and 5a, a plate 44d is connected to a vibratory head 3d by means of a single wide rail 20 which extends along the length of the plate and which has essentially a T profile. A matching wide C-shaped rail 21 which grasps the cross section of the T profile is slid laterally onto the rail 20. A catch mechanism 36a such as was used for the example embodiment in Figure 1 is used for locking. It has a bent leaf spring 38a and a detent ball 37a. The catch mechanism 36a is placed in a cutout 49 in the T-shaped rail 20.

To connect the sanding tool 4d to the vibratory head 3d, the sanding tool 4d is slid laterally onto the vibratory head 3d until the detent ball 37a snaps into a matching concavity in rail 21 of the sanding tool. To disconnect them, the sanding tool is slid in the direction of the rail with enough force so that the detent ball 37a is released from the concavity.

In the example embodiment shown in Figures 6 and 6a, the base plate 7e of the sanding tool 4e has a circular convexity 28 which fits into a complementary matching circular concavity 29 in plate 44e of the vibratory head 3e, so that the flat surfaces 5e and 6e of the vibratory

head 3e and of the sanding tool 4e fit together. The connection between plates 44e and 7e is provided through the plates 44e and 7e being magnetized, drawing the plates together. 50 indicates a hole at the side of plate 44e into which a suitable tool can be introduced to separate the plates, which adhere because of the magnetic force, if the sanding tool is to be removed from the vibratory head.

In the example embodiment shown in Figures 7 and 7a the base plate 7f of the sanding tool 4f has a projecting tongue 30 to match a groove formed in the plate 44f of the vibratory head 3f, with the tongue and groove both having trapezoidal cross sections. To connect the sanding tool 4f to the vibratory head 3f, the sanding tool is slid laterally onto the vibratory head. The flat surfaces 5f and 6f of the vibratory head and the sanding tool come into mutual contact, improving the stability of the connection. In this example embodiment, the tongue and groove do not extend over the full length of the plates 44f or 7f, but extend only to a stop piece 32. A catch mechanism as in the example embodiments of Figures 1 and 5 is used as the locking mechanism, which is not shown in Figure 7.

Figures 8 and 8a show an example embodiment in which a bayonet connection 33 is used to connect a vibratory head 3g and a sanding tool 4g. The bayonet connection is shown schematically in Figures 8 and 8a. In this example embodiment, plate 44g of the vibratory head 3g and the base plate 7g of the sanding tool 4g each have three connecting segments. Figure 8a shows the segments 51 fastened to plate 44g. Locking mechanisms by which the combined segments of the bayonet connection can be made solid are not visible in Figure 8. As an example, a locking mechanism such as that shown in Figure 2 could be used, arranged in the vicinity of one of the corners of plates 44g and 7g. The sanding tool 4g is connected to the vibratory head 3g through the bayonet connection in a known manner such that the connecting elements of one part of the connector are inserted into the spaces between the connecting elements in the matching connecting part and the connecting segments of the matching connecting parts are slid together by rotation.

In the example embodiment shown in Figures 9 and 9a, the base plate 7h of one sanding tool 4h has a projecting circular part 52 which fits into a corresponding circular concavity in the flat surface 5h of plate 44h of the vibratory head 3h. The projecting part 52 has an external thread and the depression 53 has a matching internal thread designated as 34 such that the vibratory head and sanding tool can be screwed together.

No special lock is necessary in the example embodiment of Figures 9 and 9a because the threads achieve not only an intermeshing but also a locking action. The large thread diameter assures that vibrations will not loosen the connection and that the sanding tool will not turn into misalignment with the vibratory head.

Patent Claims

1. Vibratory sanding machine with a grip part (2), a machine housing holding a drive mechanism (1) and a vibratory head (3) which can be connected to a sanding tool (4) driven by the drive mechanism, characterized by the facts that a set of different sanding tools is provided and that there are provided, in order to make a quick connection to connect the vibratory head (3) to the tools (4), a first connecting part fastened to the vibratory head and a second connecting part fastened to the sanding tool (4), which is a counterpart to the first connecting part such that it can be brought into engagement with the first connecting part to make a mechanical link, and a locking mechanism which locks the connecting parts in mutual engagement.

2. Vibratory sanding machine according to Claim 1, characterized by the fact that the vibratory head (3) and the sanding tool (4) have flat surfaces (5,6) which face each other and on which the connecting parts are mounted.

3. Vibratory sanding machine according to Claim 2, characterized by the facts that one of the two connecting parts comprises convexities (28, 30) projecting from one of the flat surfaces (5,6) and that the other connecting part comprises concavities (29, 31), into the other flat surface.

4. Vibratory sanding machine according to one of Claims 1 to 3, characterized by the fact that the connecting parts have surfaces which are complementary to each other.

5. Vibratory sanding machine according to one of Claims 2 to 4, characterized by the fact that the flat surfaces (5,6) are opposite each other in the connected state.

6. Vibratory sanding machine according to one of Claims 3 to 5, characterized by the fact that a circular convexity (28) and a circular concavity (29) are provided.

7. Vibratory sanding machine according to one of Claims 3 to 6, characterized by the fact that the projections comprise at least one pin and the depressions comprise at least one pin hole.

8. Vibratory sanding machine according to one of Claims 3 to 7, characterized by the fact that at least one tongue (30) is provided as the projection and at least one slot (31) accepting at least one tongue is provided.

9. Vibratory sanding machine according to Claim 8, characterized by the fact that the tongue (30) and the slot (31) have trapezoidal cross-sections.

10. Vibratory sanding machine according to one of the Claims 1 to 9, characterized by the fact that the connecting parts comprise one stirrup (23) and one bar (22) holding the stirrup (23).

11. Vibratory sanding machine according to Claim 10, characterized by the fact that the stirrup (23) and the bar (22) are rectangular or square.

12. Vibratory sanding machine Claim 10, characterized by the fact that the projection has an outer thread and the depression has an inner thread which can be meshed with the outer thread.

13. Vibratory sanding machine according to one of Claims 1 to 12, characterized by the fact that the quick connection comprises at least one pressure connector (24 to 27).

14. Vibratory sanding machine according to one of Claims 1 to 13, characterized by the fact that the quick connection comprises at least one bayonet connection (33).

15. Vibratory sanding machine according to one of Claims 1 to 14, characterized by the fact that the quick connection comprises at least one pair (16, 17; 18, 19; 20,21) profile rails with mutually embracing cross sections.

16. Vibratory sanding machine according to Claim 15, characterized by the fact that the profile rails of the pair exhibit essentially a C profile.

17. Vibratory sanding machine according to Claim 15, characterized by the fact that one profile rail of the pair exhibits essentially a C profile and the other exhibits essentially a T profile.

18. Vibratory sanding machine according to one of Claims 15 to 17, characterized by the fact that the profile rails of the pair can be slid into each other longitudinally to produce the mechanical intermeshing.

19. Vibratory sanding machine according to one of Claims 15 to 17, characterized by the fact that the profile rails of the pair can be joined together like snap connections to produce the mechanical intermeshing.

20. Vibratory sanding machine according to one of Claims 15 to 19, characterized by the fact that each of the profile rails is joined into a single piece with one of the flat plates (3,7) forming the flat surfaces.

21. Vibratory sanding machine according to Claim 20, characterized by the fact that the profile rails are each formed by turned-over edges projecting from the flat plates (3,7).

22. Vibratory sanding machine according to one of Claims 1 to 21, characterized by the fact that locking assembly comprises a mounting screw (35) and/or a mounting nut.

23. Vibratory sanding machine according to one of Claims 1 to 22, characterized by the fact that the locking assembly comprises a catch (36, 39).

24. Vibratory sanding machine according to Claim 23, characterized by the fact that the catch is formed by the connecting parts.

25. Vibratory sanding machine according to one of Claims 1 to 24, characterized by the fact that the locking assembly comprises at least one magnet to produce a magnetic force locking the connecting parts into mutual intermeshing.

26. Vibratory sanding machine according to Claim 25, characterized by the fact that the flat surfaces and/or connecting parts are magnetized so that they attract each other.

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with 5 pages of drawings

Translator's notes

1. I have called this machine a sander because the second paragraph of the description says it is used on wood. It might also be called a grinder if metals were involved.

2. German column 3, line 23; "Klettverschluss":
Velcro fastener. Properly 'Velcro ®'; and perhaps even more properly described generically; but there are no really good U. S. generic terms, and everyone recognizes 'Velcro'.

3. German column 3, line 46; "Schleifkugel":
translated as the "grinder ball", but very questionably.
It seems to me that it is more of a "Verschlusskugel" — i. e., a 'locking' ball. Or, as just below, a "Rastball" ("catch ball"), or, as just above, a 'locking hemisphere'.

4. German column 5, lines 21 and 27
The German text at line 2 1 implies that rail **20** runs in the long dimension of plate **3d** (über die Länge der Platte) (and this is presumably the direction in which the plate vibrates). At line 27, though, the German text says that plate **7d** with rail **21** is slid on from the side (seitlich aufgeschoben). If the rail **20** actually runs lengthwise, then plate **7d** and rail **21** would have to slide on from the end. (Figures 5 and 5a may be consistent with that meaning.) Possibly the German at line 21 is intended to mean that the width of rail **20** extends across the length of plate **3d**, but Figures 5 and 5a are not consistent with that.

I do not want to alter the statement in the patent, but I do wonder if it is actually correct in the original German.

5. German col. 5, line 62
The description of a tongue and groove with trapezoidal cross-sections is really best expressed in English by the term "dovetail". I have not used it because the German text does not use the German term ("Schwalbenschwanz").

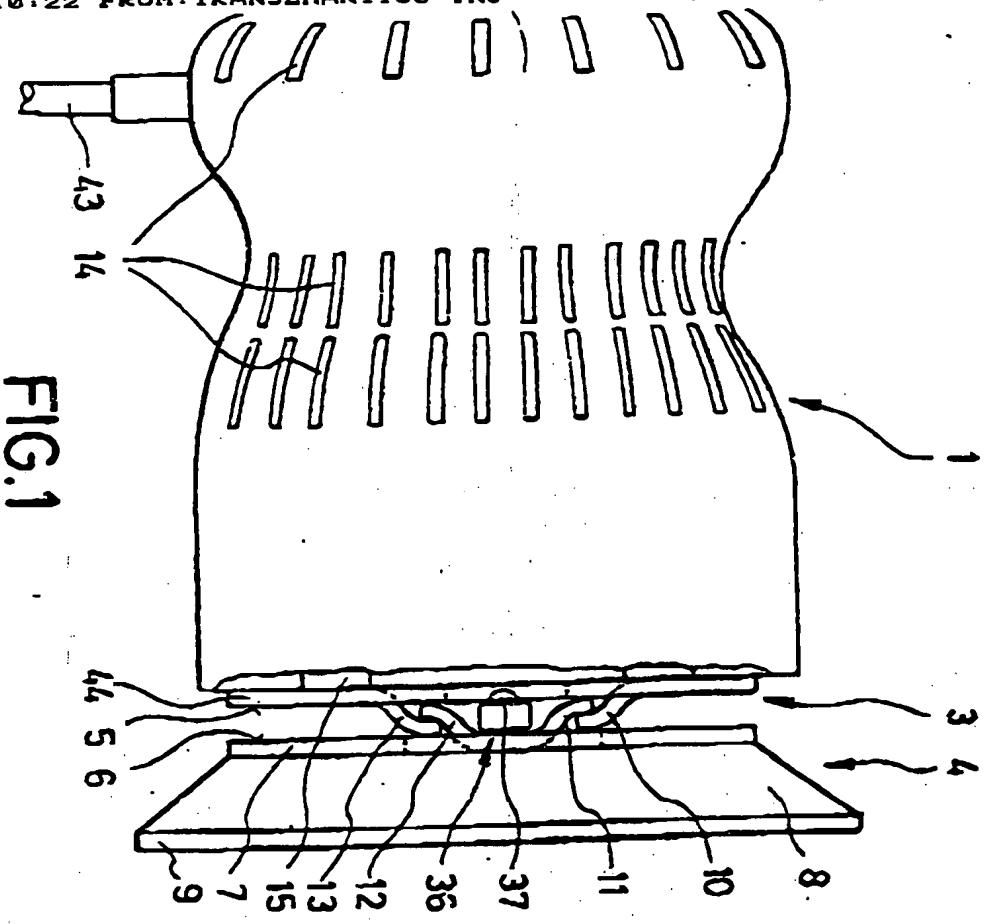

FIG.1

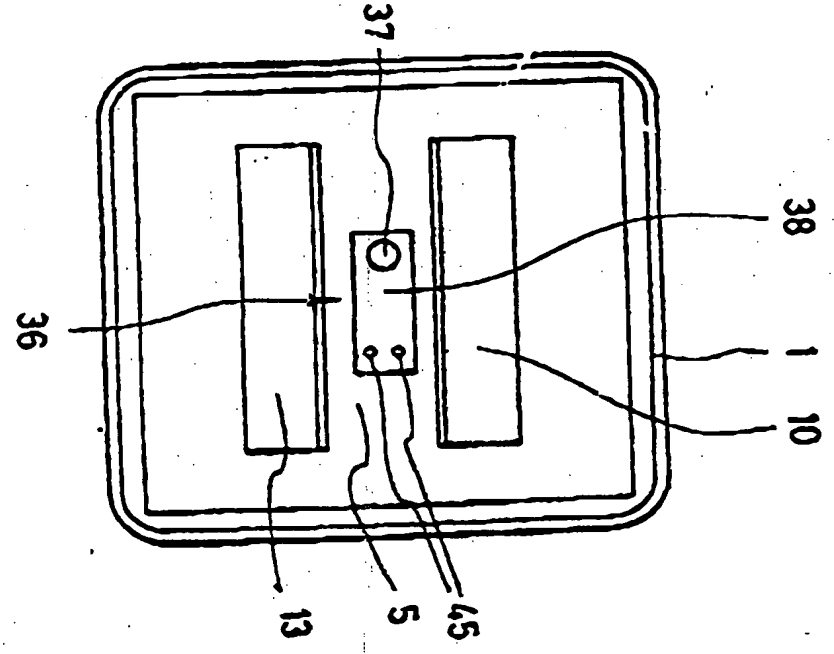

FIG.1A

DE 40 11 761 A1
B 24 B 23/03
17. Oktober 1991
Offenlegungstag:
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Nummer:

ZEICHNUNGEN SEITE 1

Nummer: DE 40 11 761 A1
Int. Cl.5: B 24 B 23/03
Offenlegungstag: 17. Oktober 1991

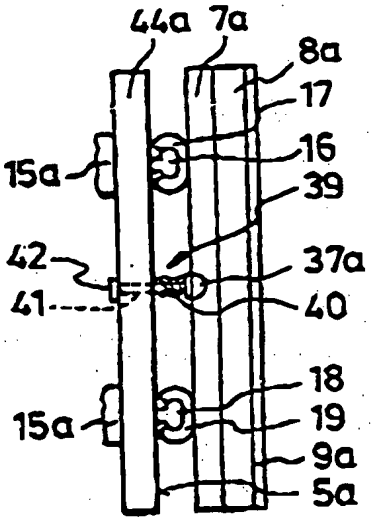

FIG.2

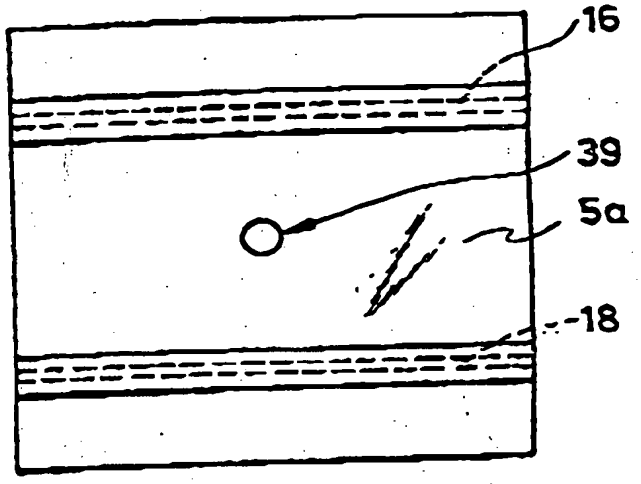

FIG.2A

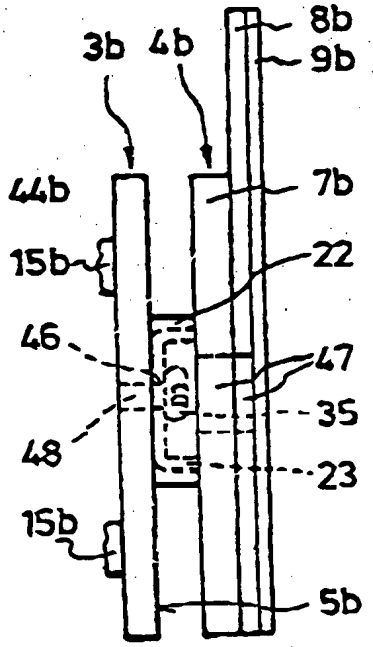

FIG.3

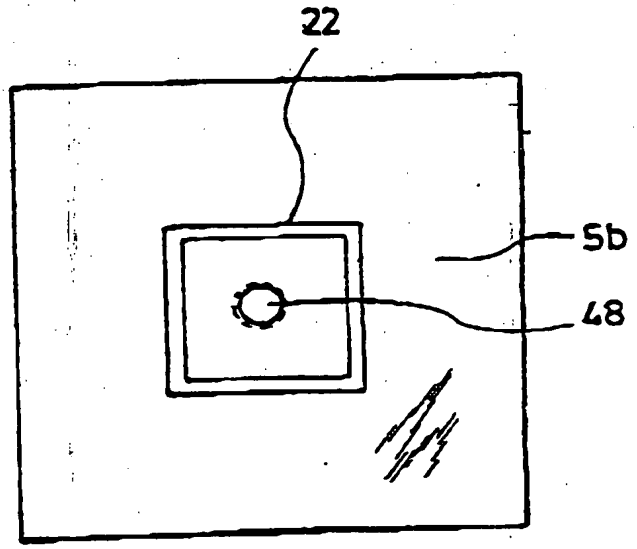

FIG.3A

Nummer: DE 40 11 761 A1
Int. Cl.5: B 24 B 23/03
Offenlegungstag: 17. Oktober 1991

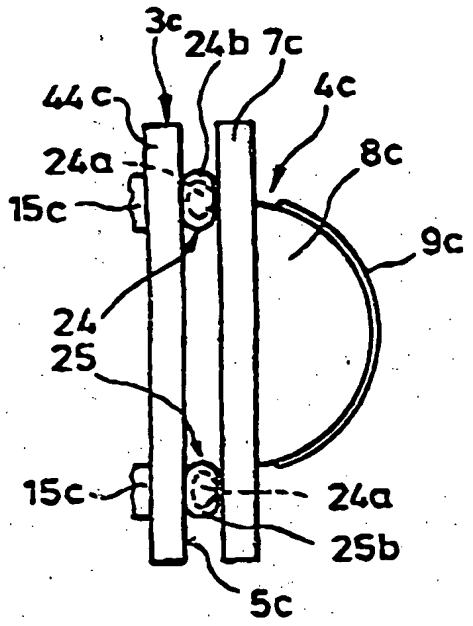

FIG.4

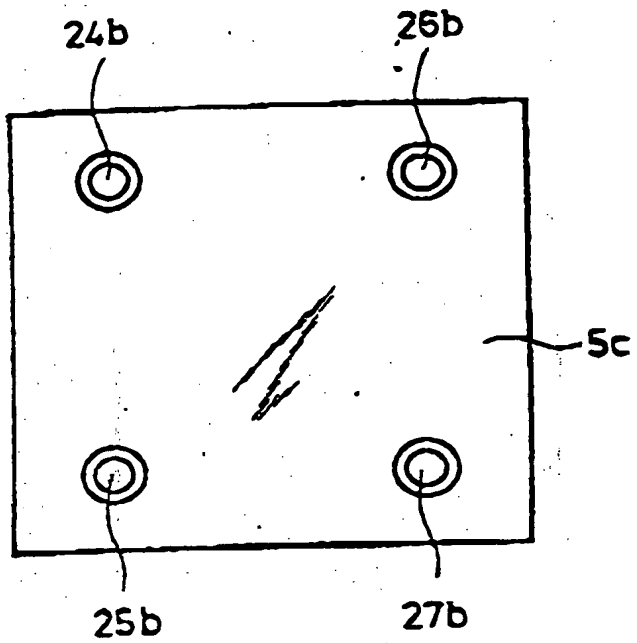

FIG.4A

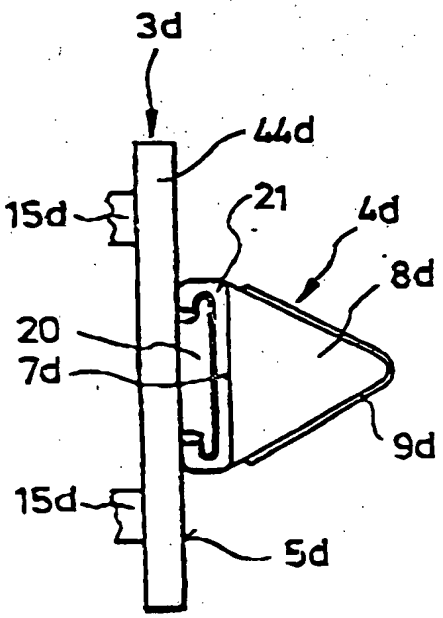

FIG.5

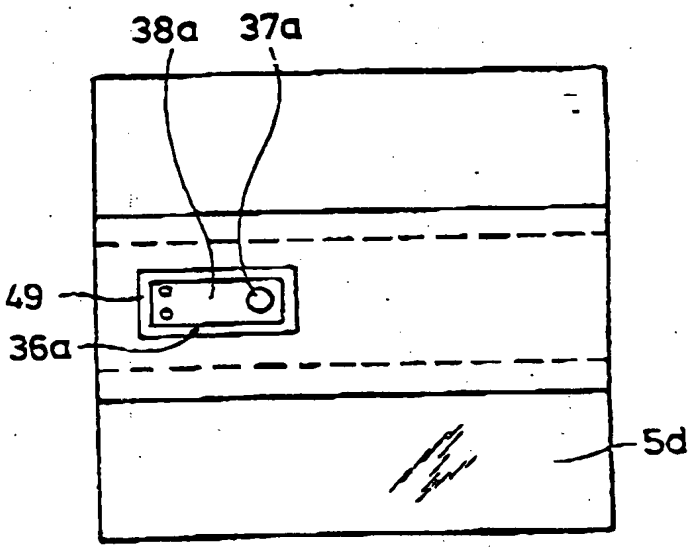

FIG.5A

Nummer: DE 40 11 761 A1
Int. Cl.5: B 24 B 23/03
Offenlegungstag: 17. Oktober 1991

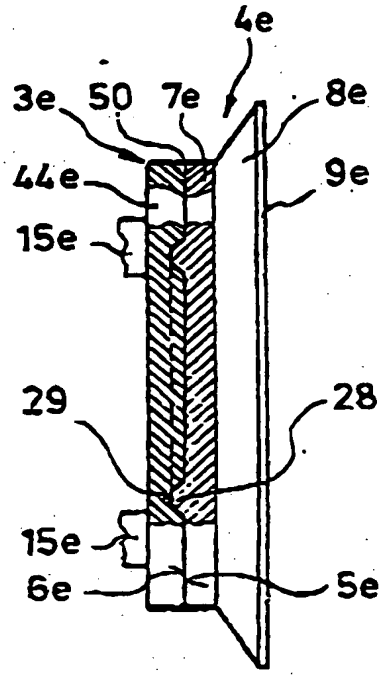

FIG.6

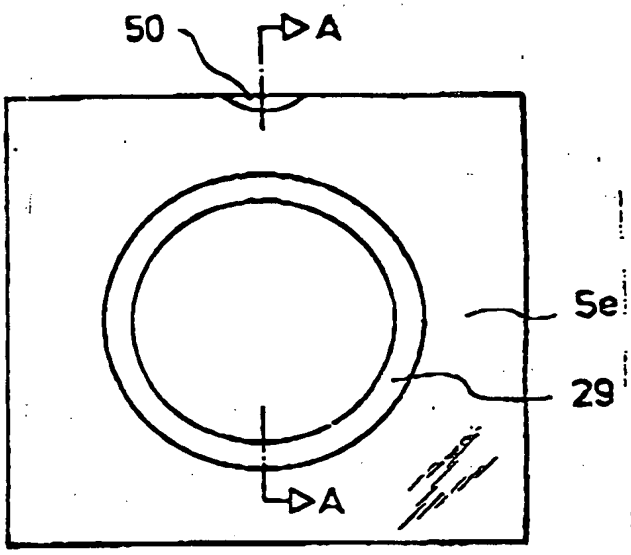

FIG.6A

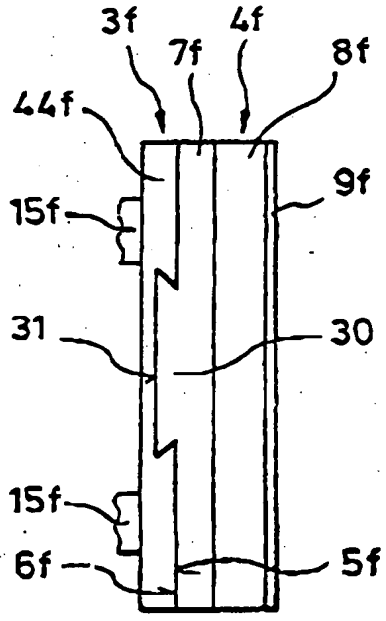

FIG.7

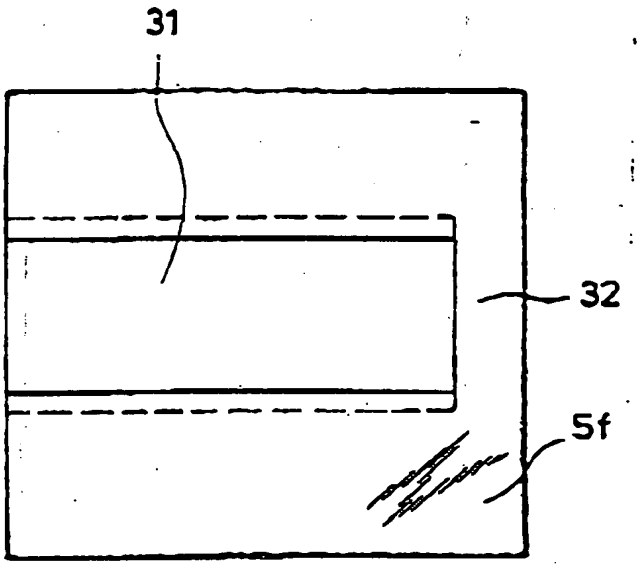

FIG.7A

Nummer: DE 40 11 761 A1
Int. Cl.⁵: B 24 B 23/03
Offenlegungstag: 17. Oktober 1991

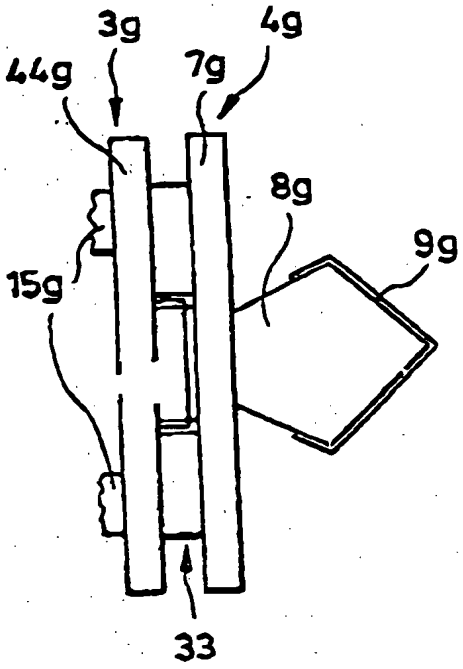

FIG.8

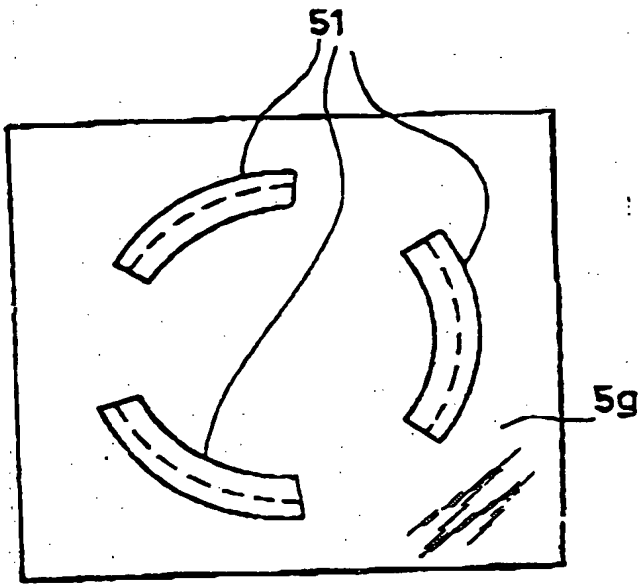

FIG.8A

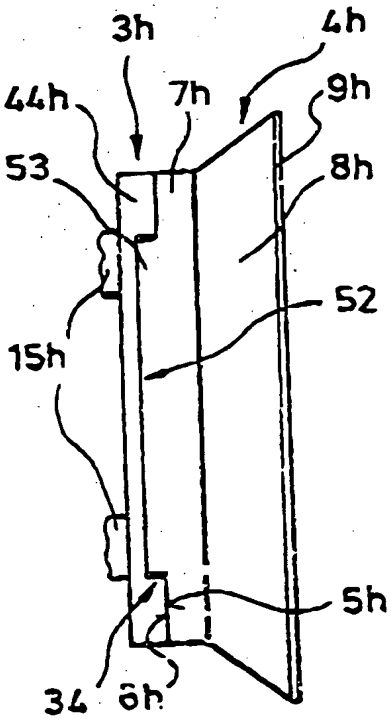

FIG.9

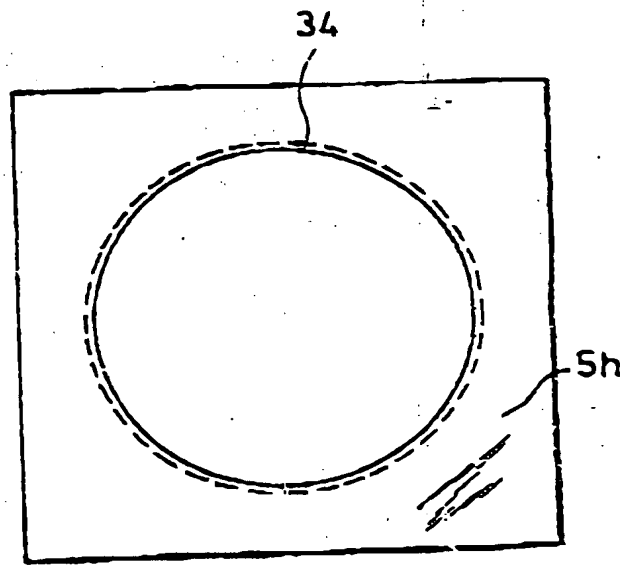

FIG.9A